Operating Experience Weekly Summary 97-38

September 12 through September 18, 1997

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EVENTS

1. OPERATOR ERROR RESULTS IN SCRAM OF SOLUTION HIGH-ENERGY BURST ASSEMBLY

On September 11, 1997, at the Los Alamos National Laboratory, an operator error resulted in a scram of the Solution High-Energy Burst Assembly (SHEBA) during a subcritical operation. The operator failed to verify adequate vacuum in a purge gas accumulator as required by a pre-operational checklist, and a vacuum sensor for the accumulator sent a signal to the scram circuit causing the scram. Operators are procedurally required to maintain the accumulator pressure between 15 and 20 inches of mercury gage. Verification of the accumulator pressure is included on the SHEBA pre-operational checklist. Although there was no impact to the health and safety of personnel or the environment, the failure to follow procedures resulted in the scram of the assembly. (ORPS Report ALO-LA-LANL-TA18-1997-0012)

The assembly produces fission gases from its nuclear material during critical operations. A purge gas system removes the fission gases from the fuel assembly by maintaining a flow of nitrogen over the fuel. This prevents pressurization from the accumulation of fission gases. The mixture of fission and purge gases is drawn into an effluent accumulator, which is maintained at a sub-atmospheric pressure. The operator noted that the accumulator pressure was below zero when he performed the pre-operational checks, but he continued the procedure. He thought this pressure was adequate because the planned subcritical operation would not generate fission gases. However, during subcritical operation, nitrogen gas flows over the fuel and adds to the gas volume in the accumulator, even though fission gases are not being produced. When the vacuum reached zero inches of mercury, the vacuum sensor triggered the scram of the assembly. Operators stopped the operation and evaluated their indications. Based on the evaluations, they determined the scram was caused by the loss of vacuum in the accumulator. The facility manager convened a critique and determined the cause of the event was operator error.

NFS has reported procedure issues in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-12 reported that a fuel handler at the Brookhaven National Laboratory Medical Research Reactor completed and signed written fuel-handling procedure steps without noticing they contained errors. The fuel handler completed the fuel-handling operation correctly without following the procedure. (ORPS Report CH-BH-BNL-BMRR-1997-0001)

- Weekly Summary 96-50 reported that an operations technician and a trainee at Argonne National Laboratory—West did not refer to a reference-only procedure before starting the disassembly of an irradiated fuel subassembly. As a result, two fuel pins fell off the positioning grid. (ORPS Report CH-AA-ANLW-HFEF-1996-0009)

- Weekly Summary 94-42 reported that operations personnel at the Savannah River Site Receiving Basin for Off-Site Fuel violated facility procedures when they modified a fuel-handling tool without receiving approval from design engineering. (ORPS Report SR--WSRC-RBOF-1994-0012)

- Weekly Summary 94-38 reported that a shift supervisor and an operator at the Brookhaven National Laboratory High Flux Beam Reactor dropped a spent fuel element during fuel-handling activities. The operator, although experienced, was unfamiliar with portions of the procedure and performed work that was not in accordance with normal practices or the procedure. (ORPS Report CH-BH-BNL-HFBR-1994-0011)

OEAF engineers reviewed the Occurrence Reporting and Processing System (ORPS) database for procedure violations across the DOE complex and found 2,010 occurrences reported from 1995 to present. Figure 1-1 shows that facility managers reported personnel errors as the root cause for 44 percent of the occurrences. They also reported that management problems accounted for 36 percent of the violations. Further review shows that 41 percent of the personnel errors were reported as inattention to detail and 46 percent were reported as procedure not used or used incorrectly.

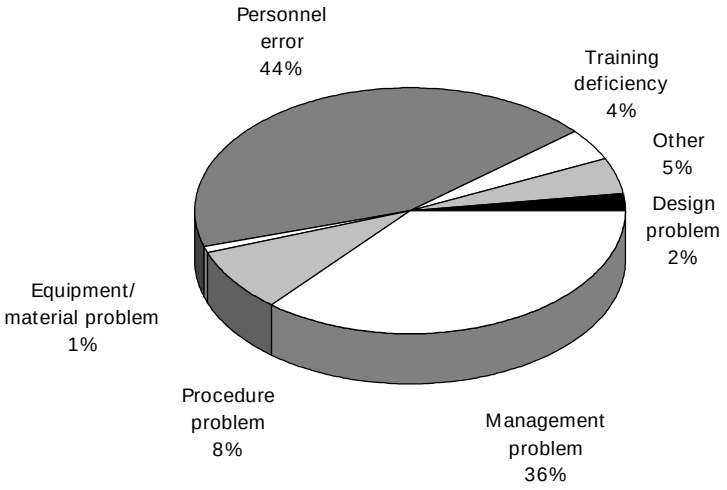

Figure 1-1. Distribution of Root Causes for Procedure Violations[1]

These events underscore the importance following procedures step-by-step. Workers must assume responsibility for their work, pay attention to detail, and adhere to procedures and instructions. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities*, chapter XVI, "Operations Procedures," provides the following guidance for procedure use.

- Operators should understand the requirements for procedures.
- Operators should conduct facility operations in accordance with applicable procedures that reflect the facility design.
- Operators should have procedures with them and follow them in a step-by-step manner when the procedures contain sign-offs for various activities.
- Operators should reference procedures during infrequent or unusual evolutions when they are not intimately familiar with the procedure requirements.
- Operators should review emergency procedures following the performance of immediate actions to verify that all required actions have been taken.

Operations procedures provide direction to ensure that the facility is operated safely and within its design basis. Procedures are also a key factor affecting operator performance.

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1 OEAF engineers reviewed the ORPS database using the Graphical User Interface (GUI) for nature of occurrence 1F, Violation/Inadequate Procedures, reported during the period 01/01/95 to present. This review found 1,983 reports with 2,010 occurrences.

KEYWORDS: procedures, operations

FUNCTIONAL AREAS: Procedures, Operations

2. VITAL SAFETY SYSTEM MODIFIED WITHOUT APPROVAL

On September 11, 1997, at Rocky Flats Environmental Technology Site, a quality assurance engineer discovered that a subcontractor added temporary welding outlets to an emergency motor control center without the appropriate reviews or approvals. The emergency motor control center is a vital safety system. While installing a new system for waste stream processing, a subcontractor construction worker determined that he needed to install some welding outlets. His work package did not address installation of the welding outlets, so the primary contractor's engineering group initiated and approved a work package for the subcontractor to add them. However, they did not obtain facility management and engineering reviews or approvals. Facility maintenance personnel determined that the subcontractor's electricians installed the outlets using cable that was under-rated. The use of unauthorized and inadequate work control packages can result in equipment damage, personnel injury, and the undetected degradation of equipment and systems essential for safety and accident mitigation. (ORPS Report RFO--KHLL-371OPS-1997-0078)

The facility manager held a fact-finding meeting. He determined that, during a close-out review of the work package, a quality assurance engineer noticed that (1) facility management and engineering had not signed the work package, (2) the work package did not include an engineering package for design modifications and electrical load calculations, and (3) independent verifications for the installations were not performed. Meeting attendees also learned that the primary contractor was not familiar with the work package approval process and believed they had the authority to initiate and approve work packages without building management and engineering concurrence. The facility manager determined that the primary contractor received a memorandum from the facility Electrical Engineering Department stating that a modification to connect temporary welding outlets to the emergency motor control center was within the design limits for the system. The contractor assumed this memorandum was permission to perform the work. When they prepared the memorandum, the facility engineers failed to recognize that the connections would constitute a modification to a vital safety system.

During the fact-finding meeting, the facility manager determined that the subcontractor installed the welding outlets on August 28, the day before a holiday weekend, and no work was performed over the weekend. On September 2, facility maintenance personnel performed a routine walk-down of all facility welding outlets and noticed that the cable for the outlets installed on the emergency motor control center was not the correct amperage rating. They locked out and tagged the breakers for the outlets. The facility manager also determined that no one used the outlets because the primary contracting organization shut down all work on September 2 to address work control and safety issues. When subcontractor construction workers returned to work on September 3, the breakers were locked and tagged out, preventing the use of the welding outlets. A week later, the quality assurance engineer discovered the problems with the work package.

The facility manager directed Training Department instructors to train contractor and subcontractor personnel on the work control and work package processes. He also directed them to train the facility engineering group on the Conduct of Engineering Manual and Conduct of Operations Manual requirements for modifications to vital safety systems. He directed facility personnel to formally define and disseminate the chain of command for the interface between facility construction management and contractors. He also told facility electricians to modify the lockout/tagout on the emergency motor control center breakers to indicate that installing the welding outlets was an unauthorized modification. Nuclear safety personnel will perform an

unreviewed safety question screening for the work package and issue a site-wide lessons learned report for this event.

NFS has reported on contractor and subcontractor work control deficiencies in several Weekly Summaries. Following are some examples.

- Weekly Summary 97-32 reported that contractor mechanics at the Los Alamos National Laboratory caused a positive ventilation condition in a wing of a building while performing preventive maintenance on a compressed air system dryer. The contractors incorrectly positioned valves associated with the air dryer, allowing air to bleed from the opening mechanisms which caused exhaust dampers to close. Investigators determined that weaknesses in the work control process allowed the contractors to work on the system without adequate knowledge and without facility management approval. (ORPS Report ALO-LA-LANL-CMR-1997-0009)

- Weekly Summary 96-29 reported that a contractor engineer and an off-site vendor at Rocky Flats Environmental Technical Site performed adjustments to a supply fan controller without a work control package or procedures and without the knowledge of building managers. (ORPS Report RFO—KHLL-SOLIDWST-1996-0095)

- Weekly Summary 95-11 reported an event at Los Alamos National Laboratory where contractor work control deficiencies led to the blood lead levels of five employees exceeding the OSHA levels for workers. The workers were exposed to lead while removing lead paint from the inside of a tank. The final report, issued on September 16, 1997, described multiple work control failures. (ORPS Report ALO-LA-LANL-PHYSTECH-1995-0004)

OEAF engineers searched the ORPS database for reports involving contractor work control weaknesses and found 860 occurrences. Figure 2-1 shows the distribution of root causes reported by facility managers for these events. Management problems represented 66 percent of the root causes. Inadequate administrative control accounted for 41 of the management problems, and work organization/planning deficiencies accounted for an additional 31 percent.

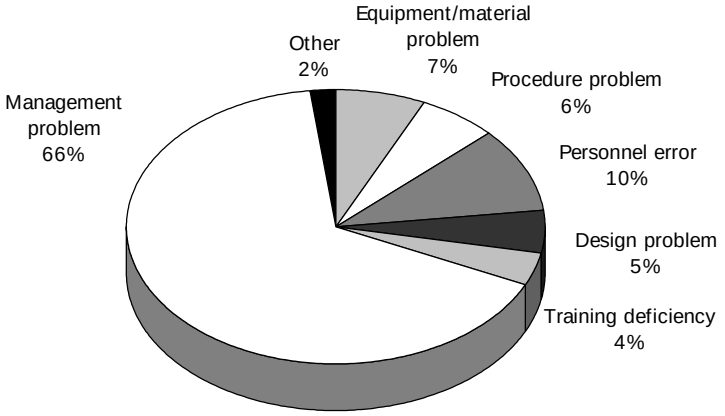

Figure 2-1. Distribution of Root Causes for Contractor Work Control Weaknesses[1]

[1] OEAF engineers searched the ORPS database using all narrative for reports containing @contractor@ AND work AND (control@ OR process@) AND (weakness@ OR deficienc@) and found 860 occurrences. Based on a random sampling of 25 events, OEAF engineers determined that each slice is accurate within ± 0.98 percent.

This event illustrates the need for facility managers to ensure that contractors understand and follow work control and configuration management programs. In this event, the contractor believed they had the authority to initiate and approve work packages without additional approvals. This is an indication that the contractor either did not understand or did not follow established facility work control programs. It also indicates that facility management failed to adequately communicate the importance of work control programs to the contractor. Facility managers are ultimately responsible for ensuring successful completion of work activities. Routine monitoring of contractor and subcontractor work by facility managers and supervisors will help ensure that maintenance activities are conducted in accordance with facility policy and procedures.

Many DOE Orders, standards, and guidelines addressing work control programs, training, conduct of operations, correct electrical installations, independent verifications, and the adequacy of technical staff are applicable to this event. Facility personnel responsible for work that is performed by contractors should clearly understand their responsibilities. They should review the following Orders and standards to ensure adequate oversight and control of work activities that are performed by contractors.

- DOE O 4330.4B, *Maintenance Management Program,* chapter 15, "Management Involvement," identifies the degree of management involvement in oversight and approval of maintenance activities. Chapter II, section 8.3.1, "Work Control Procedure," provides guidelines on work control systems and procedures and states that work control procedures help personnel understand the necessary requirements and controls. Section 8.3.6, "Control of Non-facility Contractor and Subcontractor Personnel," states that contractor and subcontractor personnel who perform maintenance or modifications on facility systems should be trained and qualified for the work they are to perform. This section also states that contractor and subcontractor personnel should receive training on facility administration, safety, quality control, radiation protection procedures and practices, and general employee training.

- DOE-STD-1073-93, *Guide for Operational Configuration Management Program, Including the Adjunct Programs of Design Reconstitution and Material Condition and Aging Management, Parts 1 and 2,* addresses modification technical reviews as part of the change control element. Section 1.3.4.2 of the standard recommends that changes be reviewed and approved by the design authority prior to implementation. The standard also discusses the control of modifications that can lead to temporary or permanent changes in design requirements, facility configuration, or facility documentation. The standard discusses identifying changes, conducting technical and management reviews, and implementing and documenting changes. Change management is the process of maintaining the configuration of safety requirements, procedures, and controls in agreement with the mission and facility design configuration.

- DOE-STD-1007-92, *Guide to Good Practices for Teamwork Training and Diagnostic Skills Development,* emphasizes the need for understanding organizational authority and communicating effectively to ensure a well-run team.

- DOE-STD-1050-93, *Guideline to Good Practices for Planning, Scheduling, and Coordination of Maintenance at DOE Nuclear Facilities*, provides information on work controls and coordination.

- DOE-STD-1051-93, *Guideline to Good Practices for Maintenance Organization and Administration at DOE Nuclear Facilities*, section 2.3.8, "Non-Facility Personnel," states that when non-facility personnel are used, the duties, authorities,

responsibilities, and functional interfaces with personnel should be clearly defined. Section 4.3.4, "Management Control of Plant Configuration," provides guidance to ensure plant configuration is maintained and that it conforms to established design bases.

- DOE-STD-1053-93, *Guideline to Good Practices for Control of Maintenance Activities at DOE Nuclear Facilities*, section 3.4.6 "Control of Non-facility Contractor and Subcontractor Personnel," states that contractor and subcontractor personnel should perform maintenance under the same controls and standards as facility maintenance personnel. It further states that facility supervisors should review the work of contractors and subcontractors (1) during preparation for work, (2) at the job site, (3) during post-maintenance testing and acceptance inspections, and (4) when needed to enforce requirements.

KEYWORDS: work package, temporary modification, subcontractor

FUNCTIONAL AREAS: Work Control, Electrical Maintenance, Temporary Modification

3. INADEQUATE PRE-JOB BRIEFING FOR EMERGENCY RESPONSE PROVISIONS

On September 11, 1997, at the Savannah River Site, workers evacuated to the wrong location when a continuous air monitor alarmed while they were removing contaminated concrete from a laboratory module. The workers evacuated into a contamination area where the alarming portable continuous air monitor was located and removed their fresh-air hoods. They should have evacuated through a radiological buffer area located on the other side of the laboratory module. Investigators determined that the personnel who conducted the pre-job briefing did not address emergency response provisions associated with exiting the work area. Although nasal and saliva smears from the workers measured less than the decision level, internal dosimetry personnel instructed all personnel in the area of the laboratory module to submit bioassay samples. This event is significant because evacuation information, important for minimizing the spread of contamination and personnel exposures, was not provided during the pre-job briefing. (ORPS Report SR--WSRC-ALABF-1997-0012)

Workers were using a scabbler (air-operated chisel) to chip away layers of contaminated concrete inside the module when the air hose separated from the scabbler head. Shortly after the hose broke loose, a portable continuous air monitor outside the module alarmed. When the air monitor alarmed, a radiological control inspector advised the breathing-air manifold operator and the workers to exit the area. The radiological control inspector and the air-manifold operator were stationed outside the laboratory module in a corridor, where no respiratory protection was required. The inspector detected 1,000 dpm alpha smearable contamination in the corridor near the portable continuous air monitor and 1,200 dpm alpha on the monitor filter paper.

The facility manager suspended all nonroutine work in airborne radioactivity areas pending a review of the adequacy of each pre-job briefing. He also conducted a critique. Critique members believe that airborne activity was forced into the corridor by the velocity of the air expelled from the hose to the scabbler, when it broke loose and flopped around. They re-evaluated air flows and ventilation lineups and determined they were adequate to prevent migration of contamination to

other areas. They also determined that the radiological control inspector did not believe the air monitor alarm was valid when he first heard it. He went into the area where the monitor was located to see if the alarm was false without wearing respiratory protection. Critique members also learned that two members of the emergency response team did not respond to the alarm because they were involved with radwaste operations.

NFS reported other events in the Weekly Summary where inadequate pre-job briefings were causal factors. Following are some examples.

- Weekly Summary 97-35 reported that workers at the Hanford Site did not stop work in a hot-cell when a dose rate exceeded a radiation work permit void level. Health physics personnel had increased the void level after the dose rate was exceeded on a previous work permit. The project manager mentioned the increased void level, but he did not discuss or stress the actual limit during the pre-job briefing. (ORPS Report RL--PHMC-ANALLAB-1997-0022)

- Weekly Summary 96-39 reported that two power operators at the Hanford Plutonium Finishing Plant caused a water hammer event when they opened a bypass valve instead of a diaphragm-operated valve as directed in the work package. The potential for water hammer was not discussed during the pre-job briefing. (ORPS Report RL--WHC-PFP-1996-0038)

- Weekly Summary 96-39 also reported that electricians at Argonne National Laboratory—West opened the wrong breaker while preparing to conduct electrical maintenance on a 13.8-kV breaker. Power was lost to the Fuel Conditioning Facility and the Hot Fuel Examination Facility. The pre-job briefing was inadequate because it did not convey to the electricians which breakers to open. (ORPS Report CH-AA-ANLW-ANLW-1996-0008)

These events illustrate the importance of conducting thorough pre-job briefings. Pre-job briefings are typically the last opportunity to discuss the job task and communicate important information regarding personnel safety and work-related hazards to the workers. Also, personnel should assume all alarms are valid and take appropriate actions until the alarm is proven otherwise. Personnel who are assigned to emergency response organizations should not be involved with tasks that prevent them from responding to emergencies. If this is the case, another person should be assigned as an emergency responder.

DOE/EH-0256T, *Radiological Control Manual*, article 324, “Pre-Job Briefings,” provides guidance for conducting pre-job briefings for radiological work. At a minimum, the pre-job briefing should include the following information.

- scope of work to be performed
- radiological conditions of the workplace
- procedural and radiological work permit requirements
- special radiological control requirements
- radiologically limiting conditions, such as contamination or radiation levels that may void the permit
- radiological control hold points
- communications and coordination with other groups
- provisions for housekeeping and final cleanup
- emergency response provisions

The cognizant work supervisor should conduct the pre-job briefing. Workers and supervisors directly participating in the job, cognizant radiological control personnel, and representatives from involved support organizations should attend the briefing. A summary of topics

discussed and the identity of briefing attendees should be documented and maintained with the technical work document.

KEYWORDS: pre-job briefing, radiation protection

FUNCTIONAL AREAS: Radiation Protection

OEAF FOLLOWUP ACTIVITIES

1. CORRECTION TO WEEKLY SUMMARY ARTICLES

OEAF engineers incorrectly referenced 29 CFR 1926, *Safety and Health Regulations for Construction,* sub-part .956, "Underground Lines," as being sub-part .965. That sub-part does not exist and was a typographical error. The incorrect reference was used in the following Weekly Summary articles.

- 97-35, Article 2, CONSTRUCTION WORKER CUTS ENERGIZED 480-VOLT LINE
- 97-33, Article 4, UNDERGROUND ELECTRICAL AND TELEPHONE LINES SEVERED
- 97-11, Article 5, WORKER DRILLS INTO ENERGIZED ELECTRICAL CABLE
- 96-42, Article 8, JACKHAMMER STRIKES CONDUIT AT ROCK FLATS
- 96-37, Article 6, ENERGIZED ELECTRICAL LINE STRUCK DURING EXCAVATION ACTIVITY
- 96-28, Article 5, EXCAVATOR SEVERS ENERGIZED 480-VOLT CABLE
- 96-21, Article 6, SUBCONTRACTOR SHOCKED WHILE EXCAVATING WITH A STEEL ROD

KEYWORDS: underground, electrical, cable, occupational safety

FUNCTIONAL AREAS: Industrial Safety